Cement MILL SECTION of

Concrete

Vol. 27 OCTOBER, 1925 No. 4

Petrography of Portland Cement Clinker

Reports of the Association of German Portland Cement Manufacturers

Dr. Biehl of Langereich spoke on the above subject at the Berlin meeting of the German Portland Cement Manufacturers Association on March 11-13. He attempted to show how information as to the quality of the resulting cement could be obtained from the clinker in practice by use of the polarising microscope. The question of burning and sintering was studied in the case of a series of shaft furnace and rotary furnace clinkers. The influence of the cooling conditions could be shown as well as of the addition of aids to fusion. These investigations, however, bring out very little concerning the chemical constitution. However, from the structure of the ground mass it can be seen whether little or much iron is contained. This could at least be determined, namely, that quickly cooled clinkers strongly burned gave the best cements.

In the discussion which followed it was pointed out that portland cement is a silicate in which the content of silica, lime and alumina may vary greatly and that we must be careful not to speak of alit as a definite compound. We must not expect to obtain sharply defined compounds in a clinker but only groups of minerals. Dr. Kuhl added that alit is not claimed to be a compound, but we must remember that in the many clinker materials which coexist alongside of each other, typical groups are contained of which we call one which is always prominent in good cement alit.

Dr. Kuhl of Berlin-Lichterfelde delivered the report on progress at the Technical Cement Institute of the Technical High School at Berlin. He said that thanks were due to the Association of German Portland Cement Manufacturers and to the German machinery industry for their cooperation with the Institute and for the financial support granted from state funds for the employment of assistants. The usefulness of the Institute could be greatly extended by the installation of a rotary experimental kiln presented by Polysios and the enlargement of the grinding equipment by installing a third ball mill. In the past year the cooperation with the Kaiser-Wilhelm Institute for Physical Chemistry was extended. The speaker called attention to lectures on cement and mortar at the Technical High School in Prof. Reisenegger's course of technical lectures. The Institute was so well visited by students that all available places were occupied. The courses included in their scope the method of operation investigation and preparation of portland cement substitution of the various components by others and the finding of suitable new materials.

Discoloration of Cement Clinker

Obtaining of satisfactory strength figures does not consist in a methodical increase in the lime content, but on proper proportioning of the individual components. Tests were made to determine how the reactions which proceed at the sintering temperature of portland cement can be carried out at lower temperatures. By addition to fluorspar, bonding materials can be obtained which are not inferior to portland cement. Even at low burning temperatures entectic fusions are obtained which induce clinkering. A hard burned clinker is obtained which does not slake with water and can be broken up only by a grinding process. Researches were also undertaken on the cause of the red color which sometimes appears and is ascribed to a reducing flame. However, the color change has nothing to do with the reducing flame as the tests show, but is due rather to a dissociation of the iron oxide. According to Michaelis the alumina of portland cement can be replaced by iron oxide and chromium oxide. It was interesting to determine whether the silica could also be replaced. Tests showed that small quantities of titanic acid do not affect the cement injuriously but that larger quantities are harmful and very large quantities are destructive. Titanic acid does not have the cementing power of silica. If silica is replaced by titanic acid we require a lower lime content. The problems of hardening were studied and also the solubility of calcium aluminate. It could be shown that colloidal chemical phenomena play an important part in the hydration of the aluminates. In conclusion the speaker expressed his pleasure that the cement industry and the machinery industry had evinced their interest in the Institute and that the requests for men trained in the Institute had increased. The importance of the chemist in the cement plant is greater than ever before.

In the discussion on the question of the coloration of the cement clinker it was brought out that on rapid cooling the red color often appeared while if the clinker was passed in the usual manner through the cooling drum it came out gray. Dr. Kuhl stated that the color was observed if the glowing clinker was dropped into water but that clinkers which were not quenched were also often red. This is not opposed to the theory. At the highest sintering temperature the iron is not bound but is present as metallic iron. Only at lower temperatures are the ferrites formed. The quenched clinker could easily be pressed while that taken from the kiln later had a fixed volume and shape. A further union with lime must have occurred. Dr. Grimm expressed the opinion that the browning was to be ascribed to incomplete burning. Perhaps there is a decomposition of the ferrites although experiments to determine the presence of iron oxide in the brown clinkers were not successful. Dr. Haegermann believes that the iron is present in the brown clinkers as ferric and not as ferrous iron. Mr. Scott stated that the red color is probably due to an oxidation phenomenon. According to his observations brown clinkers were obtained if the door at the bottom of the furnace was opened and the air given free access. If the door was kept closed normal clinkers were obtained.

Underground Quarrying

A Discussion of a Method of Producing Stone That Is Gaining in Favor

By R. H. SUMMER

From a paper in the *Explosives Service Bulletin* issued by E. I. du Pont deNemours & Co., Inc., Wilmington, Del.

There is a question as to whether the above title is correct, for, without a doubt, the problems encountered in taking material from the earth by underground operations —be the material ore or be it rock—are fundamentally the same and come within the province of the mining engineer. Nevertheless, it has been customary to think of operations producing rock for use as such or for the sake of its non-metallic mineral content as quarries and the accepted designation of open-pit mining affords at least an analogy for the term underground quarrying. Whatever name be used, however, we believe that information concerning the blasting methods employed in such operations will be of increasing value, for the demand for non-metallic minerals in larger quantity and higher quality grows from year to year.

Many quarries are everlastingly fighting two profit destroyers—overburden and dirty rock. It is principally by virtue of the existence of these two obstacles to the production of high-quality stone at a reasonable cost by regular quarrying methods in some localities that the so-called underground quarries have been developed. Underground mining of stone produces clean rock and avoids the expense of removing overburden. It also permits operations to go on throughout the year without regard to weather conditions. The outstanding item on the other side of the ledger is the unavoidable increase in the cost of drilling and blasting in underground workings. When overburden is very deep and expensive to remove or when clean rock commands a high price and wide market, then the increased cost of underground operations may be justified. There are some underground quarries with which I am familiar where explosives costs are comparable with those of open-face quarries. These operations are getting from three to four tons of rock per pound of explosives. It must be admitted that local conditions in these places are favorable to underground methods but the fact that blasting practice is above the average also aids in securing a low explosives cost.

Most underground quarries are developed from side hill tunnels and work the material in a horizontal plane, although some limestone deposits are being mined on a pitch, work being carried on from a shaft and to a depth of as much as 600 ft. In the horizontal workings, it is customary to drive a heading either at the top or the bottom of the seam and then blast the bench or shoot down the roof. Because of the relatively low value of the material per ton it is usually necessary for the stratum to be upwards of 16 ft. thick in order to permit of economical removal, and drilling and blasting costs are reduced quite rapidly with increased height of face, up to certain limits. After the heading is driven, each section of bench or roof which is shot absorbs its share of the high cost of driving the initial heading and the total production cost is reduced accordingly. For example, an operator working an 8-ft. stratum would have to practice rigid economy to produce a ton of material per pound of explosives, but if he can shoot down 16 feet of roof or bench from his 8-ft. heading, then he should get from 2 to 4 tons of rock per pound of explosives, thus considerably reducing his total explosives cost per ton of material.

In horizontal deposits the rooms may be advanced as large tunnels, leaving rectangular pillars for support and running crosscuts from the main tunnel as in coal mines, or circular pillars may be left for support at various distances dependent on local conditions. The size of pillar left is governed by the height and width of the room and by the condition of the roof and cap rock overlying the deposit.

When circular pillars are left, there is a greater width of face most of the time than with rectangular pillars and therefore the saw-tooth face is used to best advantage. This method of working the face is more economical because

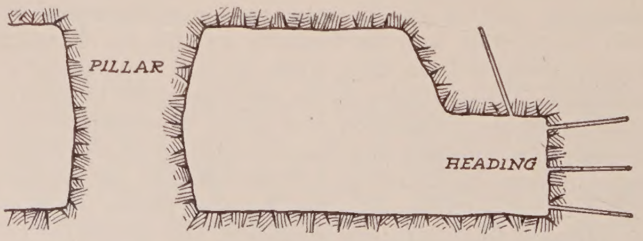


Fig. 1—Bottom heading or back stope method. A good method for faces 16 to 24 ft. high

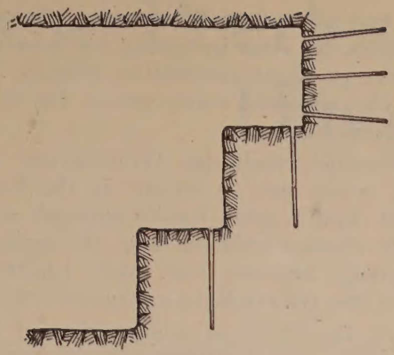


Fig. 2—Bench method, suitable for faces 24 ft. high and over

each hole always has two free faces to break to and furthermore if one hole misfires or fails to break its full burden, there is not nearly so much loss from dependent shots failing to break.

Whether the heading is driven at the top leaving a bench to be taken up, or at the bottom leaving roof to be shot down depends on one or more local conditions. Shooting the roof down, or back stoping, as this method is called in the metal mines, is an excellent practice where spawls should be eliminated, as in producing limestone for kilns. This method is especially effective if a parting can be taken advantage of as large quantities of stone can be brought down with a very low explosives consumption and, if the proper secondary blasting methods are followed, a minimum of spawls produced.

When the bench method is used and there is more than one bench, it is essential to clear the bench with the shot in order to save expensive hand labor and double handling of rock. This can usually be done by the use of the proper kind and grade of explosive and of electric firing. Careful shooting is necessary, for if the bench is over shot, labor and shovel costs increase accordingly. It is therefore important that the benches be shot hard enough to clean them and yet pile the material up properly for the particular type of shovel used, whether hand or mechanical.

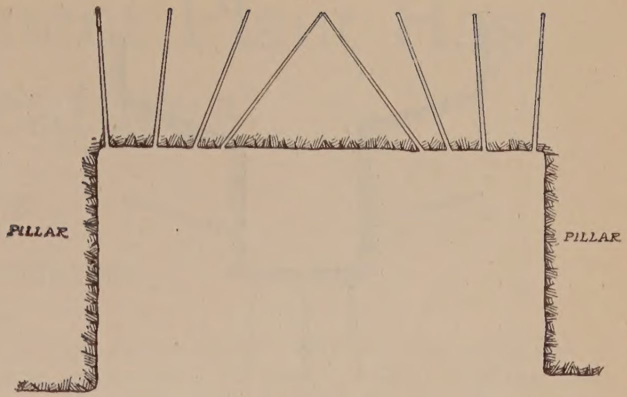


Fig. 3—V-cut method of driving the heading, leaving rectangular pillars. Center holes should be fired with electric blasting caps, and relief and rib holes with delay electric blasting caps

Sometimes the heading is driven in the middle of the seam and a combination of bench, or underhand stope method, and back stope method is used. This system is especially adapted for a seam where there are natural partings to be taken advantage of in driving the heading as a good parting at both top and bottom will reduce the cost of blasting. This combination of bench and back stope gives best results where the face is from 25 to 30 ft. high. With higher faces, unless the bench is kept vertical, too much material from back stoping will pile up on the benches.

Sectional steel has been used with some success in drilling benches from 12 to 24 ft. high so that the entire bench can be shot at one time. The heading is first cut out 8 ft. and then by joining sectional steel a row of holes can be drilled to bottom. This is of particular advantage where a mechanical shovel is used as a full shift's run of material can be shot down at once.

It is not within the scope of this Bulletin to make specific statements as to depth or burden of holes or the kind or quantity of explosives loads. There is so wide a variation among different rocks in their many characteristics that it is often impossible to determine the proper explosive without actual trial. Moreover, the same limestone seam mined in two different locations within a stone's throw of each other may require quite different grades or kinds of explosives for no other reason than that the stone from one is for burning into lime while the other is to be

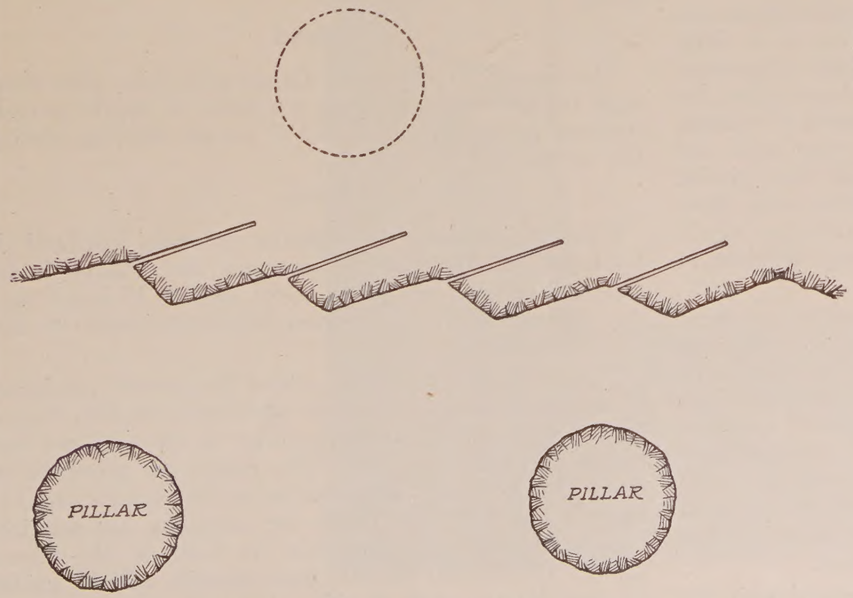


Fig. 5—Saw-tooth method of driving the heading, leaving circular pillars. A more economical method of working the face but scatters the material more

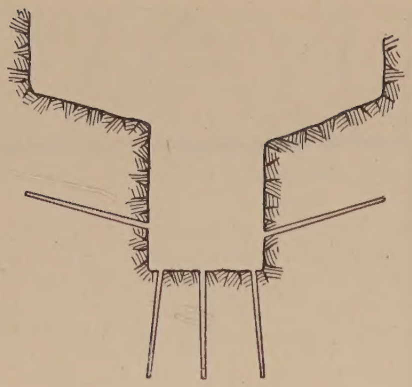


Fig. 4—Combination of bench and back stope method. Another method suitable for faces of 24 ft. and over

used simply as stone, for road building or similar purposes; or that one is hand shoveled, while the other is shoveled mechanically. Whether ventilation is good or poor may be a determining factor in the choice of explosives, as may also the diameter of the holes and the fact that they are wet or dry. In a word, all the local conditions play such an important part in the blasting that it usually requires close observation, and sometimes experiment, by an explosives export to arrive at the correct explosive for the most economical breaking cost.

Iron Oxide Cements

Many unsuccessful attempts have been made to use low grade iron ores for the manufacture of a kind of portland cement which should be superior to that corresponding to the usual standard specifications. As iron oxide resembles alumina in many ways its difference in the case of cements seemed to call for some explanation, and the subject has recently been investigated by Dr. Hans Kuhl.

It was then found, states *Zement*, that when iron oxide, silica, and marble of ordinary fineness are burned to form a clinker the product is unstable and useless, because the power which the substances have of reacting with each other is much too low! By using very pure materials (to eliminate chance errors due to impurities) and by grinding them before burning so that they passed completely through a sieve with 175 holes per linear inch good clinkers were obtained. The fuel consumption was the same as for portland cement clinker, except in those mixtures which contained an unusually high proportion of silica and a very low proportion of iron oxide, for which more fuel was needed than for portland cement. The resulting clinkers were well burned, very hard, and of a dark color; those richest in iron oxide were almost black. On keeping the 46 clinkers produced, only those disintegrated which contained a large proportion of dicalcium silicate, owing to their being very deficient in lime.

Under the microscope a clinker corresponding in composition to portland cement and containing 20% of iron oxide, 16% of silica, and 60% of lime consisted of a dark ground mass in which clear colorless crystals of high refraction were embedded. The ground mass appears to be a heterogeneous glassy mass—a sort of hotch-potch of surplus materials and consisting of a eutectic of iron oxide with the other constituents of the clinker; the crystals are the essential material and appear to be tricalcium silicate (alite) exactly as in portland cement.

Clinkers of various compositions were mixed with 2% of gypsum and ground to the fineness of cement. Most of the products are slow in setting but one sets rapidly. There appears to be no connection between the time of setting and the chemical composition, but an excess of lime destroys durability.

Under favorable conditions alumina-free cements can be obtained which are as strong as the best portland cements, and show a good tensile strength after 3 days, but they must contain sufficient iron and more silica than portland cement, because iron oxide (unlike alumina) does not produce cementitious compounds with lime.

On plotting the limits of composition of ferruginous cements on a triangular diagram, the former are located in an oval almost concentric with, but somewhat larger than, the corresponding field for portland cements, the difference in the sizes of the two fields being due to the higher proportion of silica required by alumina-free cements. The precise nature of the essential minerals in the clinker was not proved, but whilst a good cement of this type need not actually consist of a mixture of tricalcium silieate, tricalcium aluminate, and tricalcium diferrate, these appear to be substances which build up the final clinker—possibly by the formation of double compounds of these units.

Whether it would be profitable to produce ferruginous cements of this character on a large scale remains to be seen.—*Concrete and Constructional Engineering.*

The Cement Industries in Europe

The following interesting notes are abstracted from a summary in *Zement:*

Austria

The cement industry in Austria showed a marked improvement during the first quarter of 1925. After the import of cement was handicapped by a tariff, the production during the spring amounted to 370,000 tons against the maximum capacity of the Austrian cement plants of 450,000 tons.

Russia

The Soviet Government has advised the custom authorities to charge no tariff on cement which is imported from countries which reciprocally have no tariff on cement imports.

England

The Ship Canal Portland Corporation has, after thorough improvements, shown a net profit of 50,947 pounds sterling, against a loss of 33,177 pounds sterling, during last year.

France

"Societe Anonyme des Ciments Francais, Portland de Boulogne sur-Mer and Compagnie des Portland des Desvres" shows a net profit of 11,302,778,57 francs and the capital was increased from 20,000,000 francs to 20,750,000 francs.

"Cements Francais" is at present the greatest producers of cement in France. It's five absolutely modern factories are in a very favorable position as concerns raw materials and a large market. The plants are provided exclusively with rotary kilns and its present annual capacity exceeds 500,000 tons. Lately the company has acquired considerable bauxite properties in Cette at the Rhone Canal. In addition 100,000 tons capacity will be gained by consolidation with the Neuville-sur-Escaut Co.

New Peerless Cement Plant Has Unique Features

PART II

By DWIGHT F. JENNINGS

This is the conclusion of an article descriptive of the new plant and process of the Peerless Portland Cement Co., at Detroit, Mich. Part 1 describing the location and layout of the plant and the raw materials used appeared in the September issue of the Cement Mill Section of CONCRETE.

Coal

The kilns are fired with powdered coal and paralleling the operations in handling limestone and clay, coal is unloaded in cargo lots from barges at the dock or dumped in carload lots into a track hopper, conveyed on a Stearns conveyor with a 30-in. belt through a tunnel, underneath the bag house and limestone storage, to a hopper on the dock. From this hopper the coal feeds to a Pennsylvania "Armorframe" single roll crusher,* where it is reduced to ¾-in. size and is then conveyed on an inclined belt conveyor to coal storage alongside the coal mill.

Coal delivered at the dock is handled by an Orton & Steinbrenner crawler crane[12] directly from the barge to the hopper over an inclined belt conveyor at the end of the coal storage next the dock. A 3-yd. Whiting crane picks up the coal and distributes it throughout the storage or dumps it into the two hoppers over the coal house.

Coal House

The coal house is equipped with two Ruggles-Coles coal fired dryers.[13] When the coal is dumped into the hoppers by the crane, it discharges through Schafer poidometers[14] equipped with Dings magnetic separators,[15] which remove all tramp iron to belt conveyors running to the feed hoppers of the dryers. The conveyors are each driven by a 5 h.p. Western Electric motor[16] through a Palmer Bee speed reducer with a reduction ratio of 12.5 to 1 connected to a chain drive.

There are two complete units in the coal mill, each dryer being equipped with a Clarage Type S. P. No. 55 exhaust fan[17] driven by a 5 h.p. Western Electric induction motor connected by a Link-Belt silent chain drive.[18] The rotary dryers are each driven by a 20 h.p. Western Electric induction motor connected to a Link-Belt silent chain drive.

A screw conveyor for dried coal runs at right angles to the axis of the dryers and receives coal from both dryers. The conveyor is driven through a Palmer Bee No. 124

---

* Pennsylvania Crusher Company, Philadelphia, Pa.

[12] Orton & Steinbrenner Co., Chicago, Ill.

[13] Ruggles Coles Engineering Co., New York City, N. Y.

[14] Schaffer Engineering Co., Pittsburgh, Pa.

[15] Dings Magnetic Separator Co., Milwaukee, Wis.

[16] Western Electric Co., New York City, N. Y.

[17] Clarage Fan Co., Kalamazoo, Mich.

[18] Link Belt Co., Chicago, Ill.

Fig. 16—Unloading coal from barge at dock

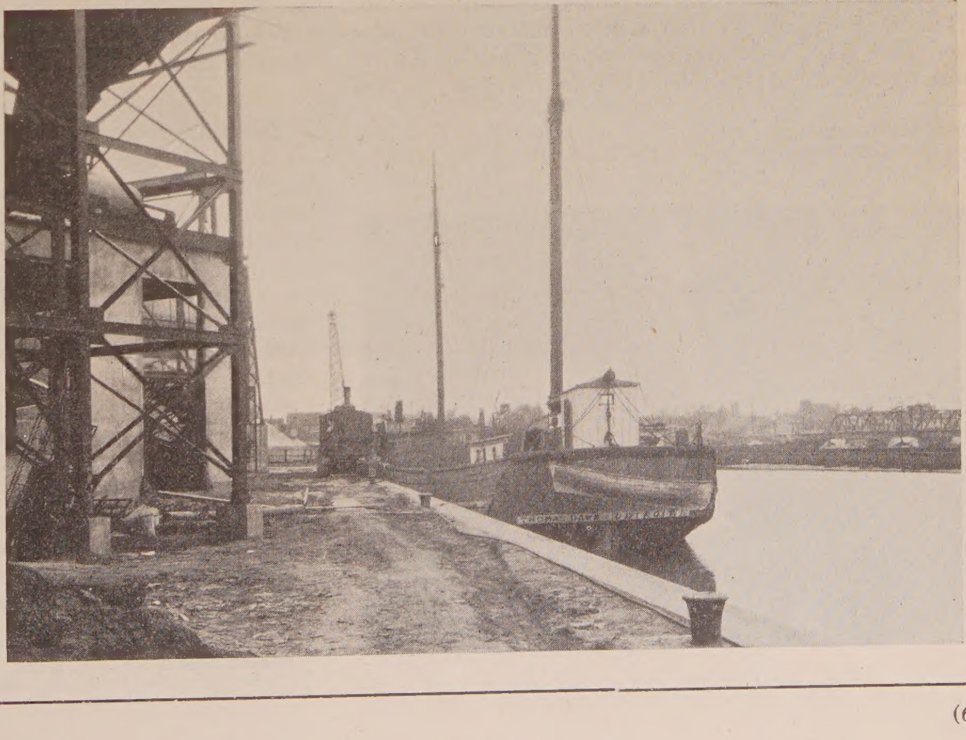


Fig. 17—First coal being received in storage

speed reducer by a 5 h.p. Western Electric induction motor connected to a chain drive which is guarded by a wire screen. Two cyclone dust collectors on the coal conveyor collect the coal dust and aid in keeping the coal house free from dust. The screw conveyor and bucket elevator in the coal grinding department are Chain Belt equipment.[19]

The coal pulverizers and pulverized coal bins are in a separate room away from the dryers, which adds another factor of safety in reducing the possibility of coal dust explosions to a minimum. The coal conveyor from the dryers discharges into the boot of a bucket elevator which elevates it to the coal bins. This elevator is operated by a 15 h.p. Western Electric motor connected to a No. 164 Palmer Bee speed reducer and a double reduction chain drive. A horizontal screw conveyor distributes the coal through slide regulated openings in the conveyor trough to the two bins, each of which has two hopper openings.

Coal is pulverized by two Raymond Super mills,[20] which have proved so efficient that it is not necessary to run them full time. Each of these mills is driven by a 200 h.p. Western Electric induction motor. A belt driven feeder regulates the coal from the hopper to the pulverizer. On each Raymond mill is a No. 14 special exhauster, driven by a 75 h.p. Western Electric motor. The powdered coal bins to be transported by a Fuller Kinyon pumping system[21] to the departments where it is used. Four cyclone dust collectors are used as air separators on the coal mills.

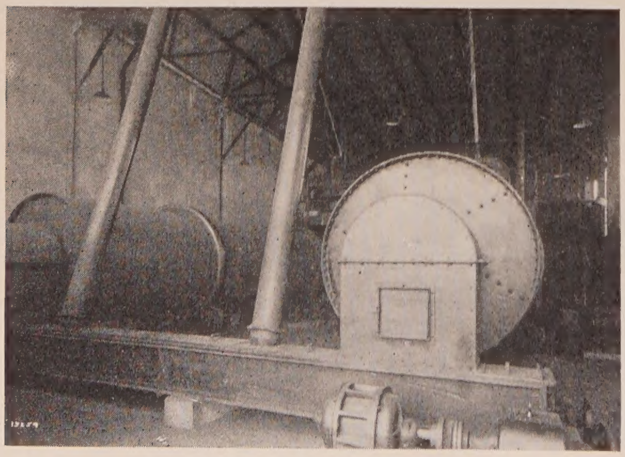


Fig. 18—Discharge end of coal dryers

The system for transporting powdered coal consists of two 8-in. Type A Fuller-Kinyon pumps each driven by a 25 h.p. Western Electric induction motor. One is used and the other is installed as an auxiliary. The system of piping leads to the kiln building and to the auxiliary boiler supply.

In the same room with the coal mills is located the 12 by 10 Ingersoll-Rand air compressor[22] operated by a 50 h.p. Western Electric induction motor. The air compressor furnishes air for the Fuller-Kinyon pump and serves to supply air for slurry agitation and for miscellaneous uses around the plant.

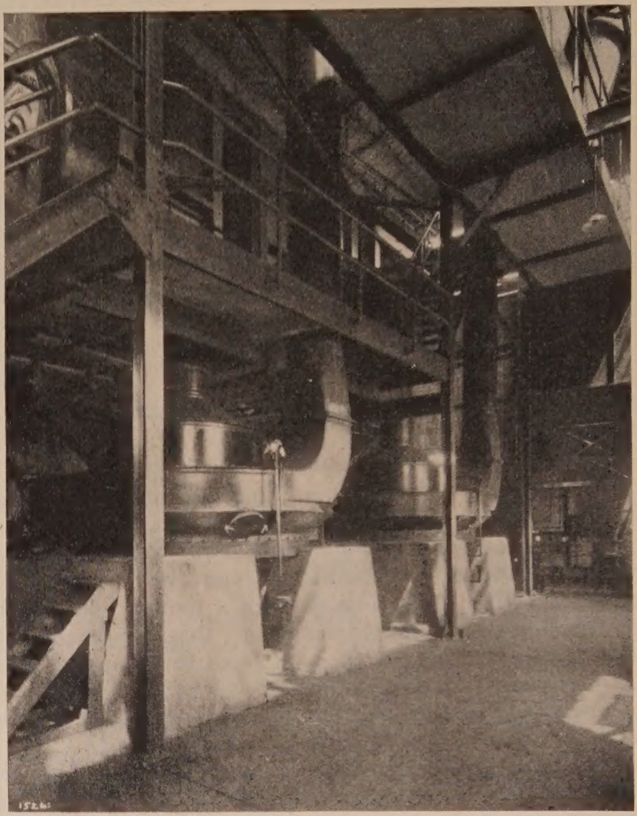


Fig. 19—Interior view of coal grinding department showing Raymond Super mills

The Kiln Room

The kiln room houses the three Traylor kilns,[23] each 11 ft. in diameter and 175 ft. long. The pulverized coal for each kiln is fed from a separate elevated steel receiving bin. Each screw conveyor for the kiln feed is operated by a Western Electric direct current motor and air for forcing the powdered coal into the kilns is supplied by a Bayley fan[24] driven by a 15 h.p. General Electric motor for each kiln. The air supply pipes for the Bayley fans are connected to the elevated coal bins to eliminate dust.

Eighty per cent of the air for combustion in the kiln is preheated, it being taken out of the clinker pit through a large pipe which surrounds the coal feed pipe as it enters the kiln. The other 20% of air for combustion is supplied by the fans for forcing the coal dust into the kilns.

An automatic electric control system signals the operators of the coal grinding department, keeping them informed as to the amount of the coal supply in the kiln feed bins.

---

[19] Chain Belt Co., Milwaukee, Wis.
[20] Raymond Bros. Impact Pulverizer Co., Chicago, Ill.
[21] Fuller Lehigh Co., Fullerton, Pa.

[22] Ingersoll Rand Co., New York City, N. Y.
[23] Traylor Engineering & Mfg. Co., Allentown, Pa.
[24] Bayley Mfg. Co., Milwaukee, Wis.

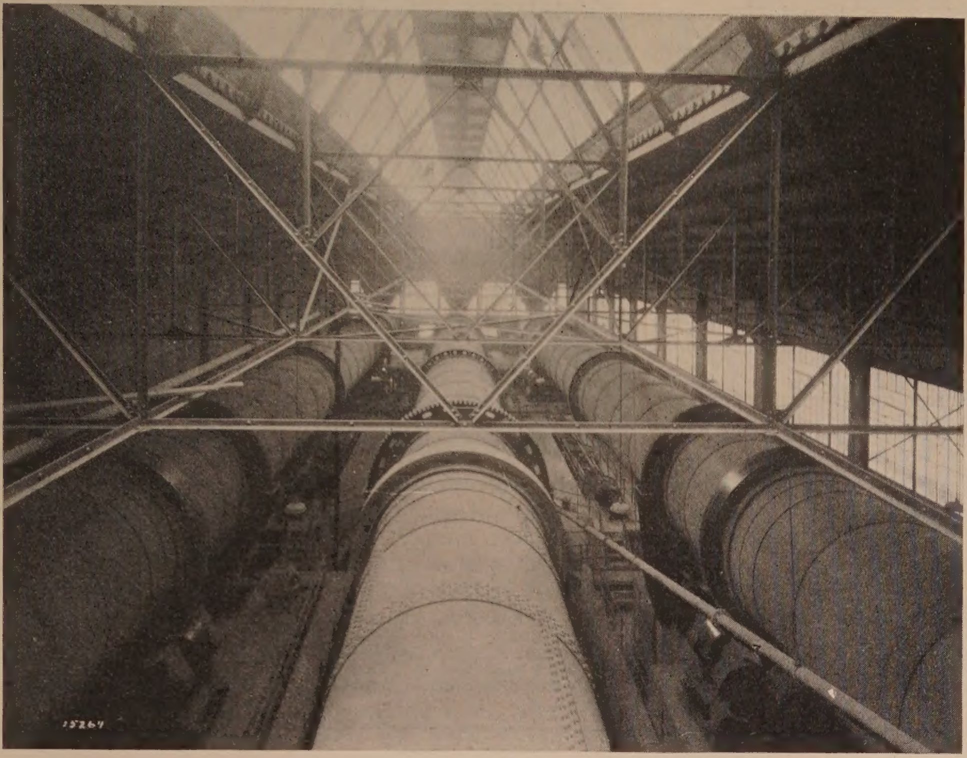
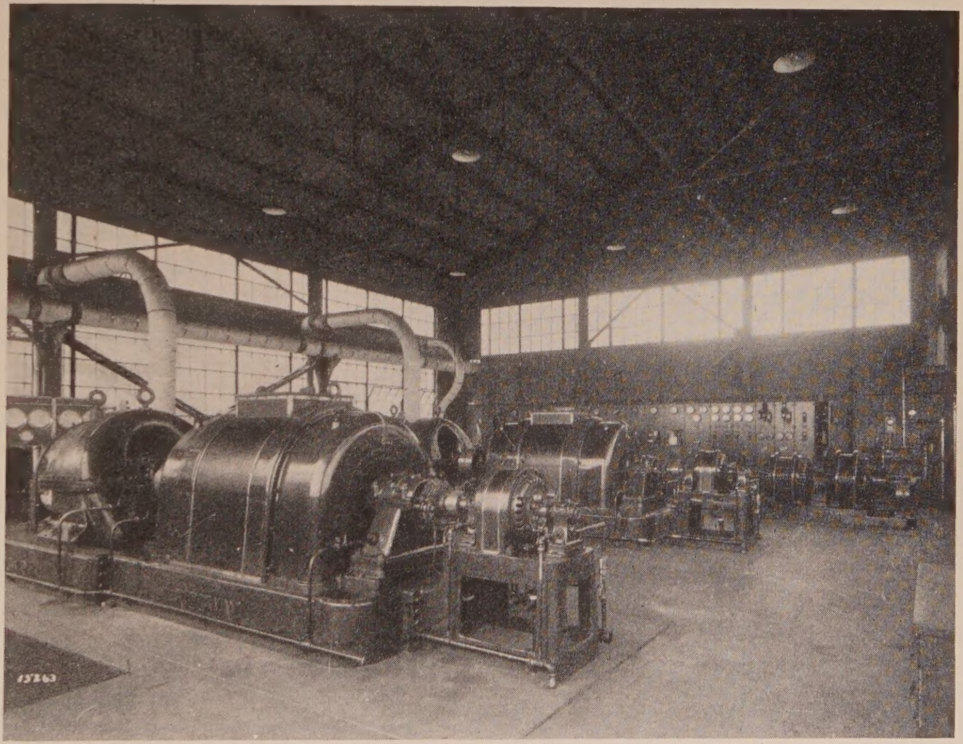


Fig. 20—Kiln building looking toward the firing end

Fig. 21—Second floor of power house showing main power units and switchboard equipment



The kilns are lined with 9 in. fire brick and a 30-ft. section in the hot zone of each kiln is lined with a special type of high alumina Kruzite brick.[25] The kilns have operated very successfully since first firing, without the formation of rings. Each kiln is driven by a 100 h.p. Western Electric induction motor and revolves at a speed of about 2 min. 10 sec. per revolution.

Hot clinker is discharged from the kilns onto Rex pan conveyor, which runs at right angles to the axis of the kilns under the firing end and up an incline and through the wall of the kiln building to discharge into the clinker storage. The clinker is sprinkled on the inclined conveyor with water from a pipe with holes distributed along a section several feet long. From the pile at the end of the conveyor the clinker is picked up by a Whiting 3 yd. crane and distributed around the clinker storage to cool.

Waste Heat Boilers

Each kiln unit is provided with two stacks, one being an emergency stack in case it is desired for any reason to shut the hot gases off from the waste heat boilers, and the other connected with the induced draft fan. The steel emergency stacks are fitted with hopper bottoms and cleanout chambers on concrete bases. The hot gases from each kiln are passed through a Ladd waste heat boiler[26] with a rated capacity of 1000 h.p. each at 210 lbs. pressure.

---

[25] A. P. Green Fire Brick Co., Mexico, Mo.

A novel feature in the waste heat boiler plant is the installation of Bayley scrubbers giving 98% dust extraction on the kiln gases. The two scrubber pumps are each operated by a 75 h.p. General Electric induction motor. The scrubbers are each driven by a Western Electric motor with horizontal shaft geared to the vertical scrubber shaft.

A 500 h.p. Ladd auxiliary boiler has been provided as a booster or for emergency use when any of the kilns are shut down. This boiler is fed with powdered coal supplied by the Fuller-Kinyon system. Other boiler room equipment includes a No. 40 Clarage blower, which supplies air for the coal feed of the auxiliary boiler, driven by a 7½ h.p. motor; two Terry turbine[27] driven American pumps[28] for boiler feed water; No. 10 Bayley Plexiform fan at stack base; American service pump driven by a 30 h.p. General Electric induction motor; one Ellison inclined draft gage[29] and two Ellison vertical draft gages; Fulton feed water heater[30] with filtering chambers and Terry service pump.

Power House

The power house is a separate building close to the waste heat boilers. On the ground floor are located the two Elliott Ehrhart surface condensors,[31] two size 107 Multiwhirl coolers[32] and the Bowser oil handling system.[33]

On the second floor there are two turbo-generator units, each having a Ridgway alternator, with 3000 k.w., 2300 volt continuous rating, which furnish the power to operate the plant. Each unit has a Ridgway exciter 21 k.w., 250 volts. A Terry steam turbine rated at 225 h.p. attached to a 225 h.p. 250 volt generator supplies current magnetic clutch exciters, synchronous motor exciter and all other direct current purposes. There is also a 250 volt Ridgway generator driven by a 225 h.p. Ridgway synchronous motor. A Whiting 10-ton overhead crane is provided to serve the second floor of the power house.

---

[26] Geo. T. Ladd Co., Pittsburgh, Pa.
[27] Terry Steam Turbine Co., Hartford, Conn.
[28] American Steam Pump Co., Battle Creek, Mich.
[29] Lewis M. Ellison Co., Chicago, Ill.
[30] Fulton Foundry & Machine Co., Cleveland, Ohio.
[31] Elliott Co., Pittsburgh, Pa.
[32] Weinman Pump Mfg. Co., Columbus, Ohio.
[33] S. F. Bowser & Co., Fort Wayne, Ind.

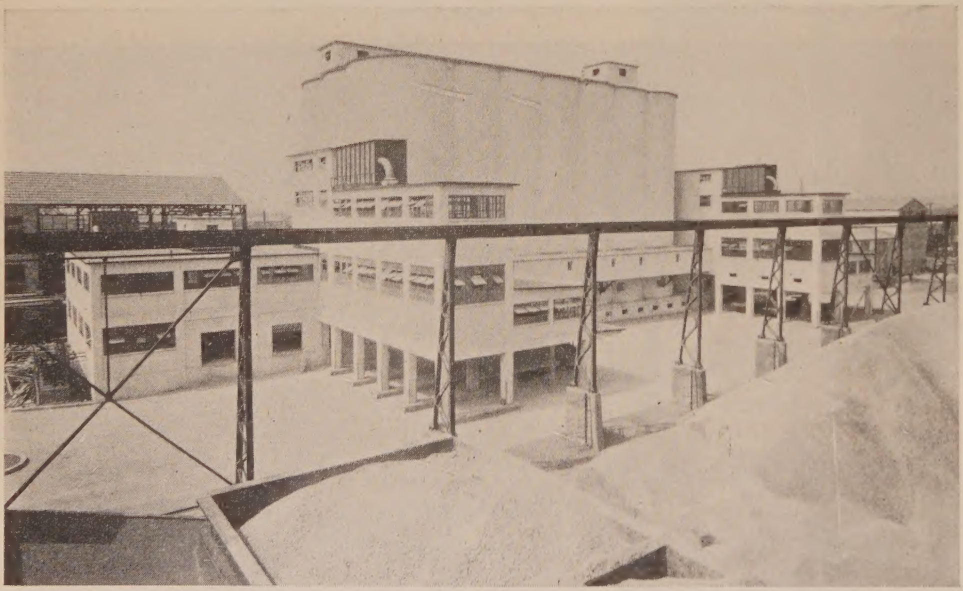


Fig. 22—Warehouse and packing department looking from the roof of the raw mill

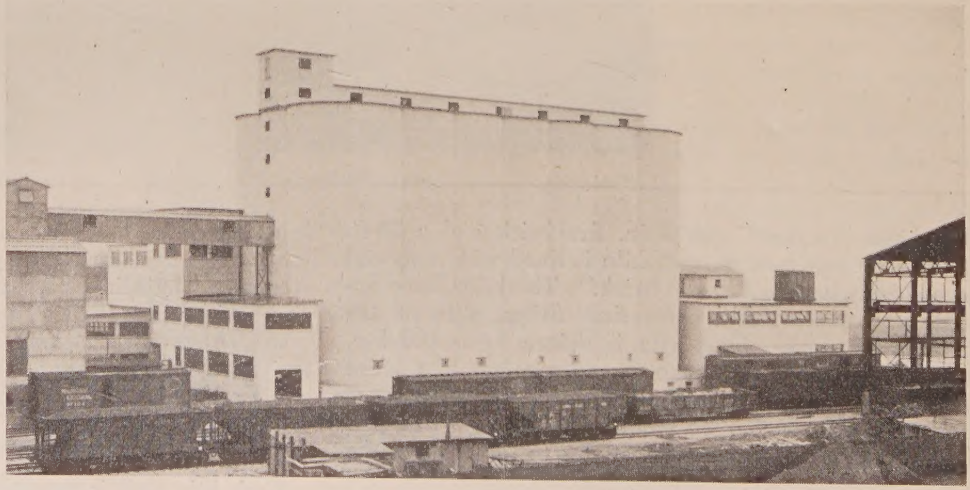


Fig. 23—Warehouse looking from the south

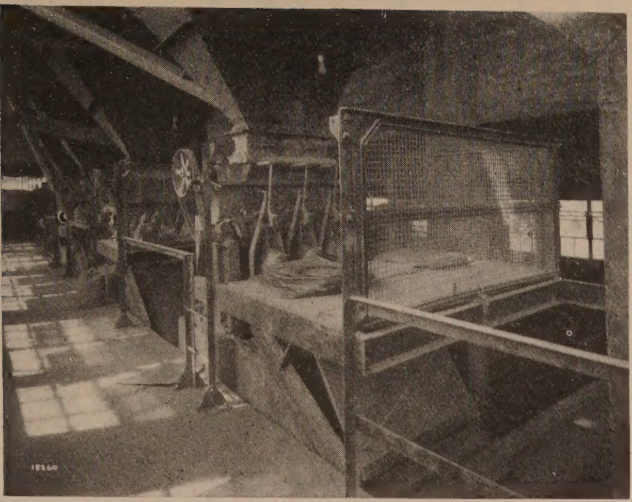


Fig. 24—No. 2 packhouse showing Bates packers and conveyor belt for loading trucks

The Bowser oil feeds operated by Worthington pumps[34] supply oil for the two large Ridgway units on the second floor.

Finish Grinding

Clinker is reclaimed from storage and transported by a Rex pan conveyor through a tunnel under the clinker storage and limestone storage to the finish grinding department, where it is brought up an incline and weighed in hoppers on Fairbanks scales[35] in batches of 6000 lbs. at a time. At the same time the gypsum is fed through a Richardson automatic scale[36] to the clinker, going to the dry tube mills.

The gypsum is unloaded from open top cars in which it is shipped to the plant from the vicinity of Grand Rapids, Mich., by a 1-yd. Whiting bucket crane and deposited in the gypsum storage next to the finish grinding department.

There are three Traylor dry tube mills for finish grinding with provision for an additional unit. These three compartment mills are similar to the raw tube mills but larger and carry 66 tons of balls each. They are 8 ft. in diameter and 26 ft. long and are each driven by a 650 h.p. Ridgway synchronous motor connected through a 66-in. Cutler-Hammer magnetic clutch. Sly dust arrestors[37] collect the cement dust over the finish grinding mills. The finish cement is conveyed by screw conveyor and elevated by a bucket elevator to the top of the silo storage where, by means of another screw conveyor and chutes, it is distributed to the various bins for storage.

Stock House

The stock house consists of eight large silos with a capacity of 20,000 bbls. each and 10 smaller interspace bins giving a total storage capacity of 200,000 bbls. of cement. Chutes in the bottom of the silo bins discharge the cement to cross conveyors that deliver it to a longitudinal screw conveyor which in turn transports it to a bucket elevator encased in a concrete housing extending to the elevation of the hoppers of the bagging machines.

There are two packing departments, one with four and one with three Bates packers.[38] The two packing rooms are identical except for the number of packers. A belt conveyor runs past the packers and delivers the filled sacks to the car on the track alongside the cement storage. By shifting the direction of the belt conveyors and lowering one end by means of a specially designed elevator arrangement, the sacks can be delivered to trucks. Thus provision is made for loading seven trucks at one time, or one truck for each packer. This is a novel arrangement designed by the engineers for the Peerless Co., and it has proved very satisfactory in operation.

On the first floor of the bag house the return bags are cleaned in a continuous revolving sack cleaner. After the bags are cleaned they are sorted and stored or repaired. The main sack storage and tying departments are on the second floor. A Sly dust collector on the roof is connected to the sack cleaner to remove the dust. The cement reclamed from the return bags is screened and returned to the bins of the packers. The mechanical equipment[39] in the cement storage and pack houses was furnished by the Webster Mfg. Co.

The Laboratory

Immediately adjoining the slurry mixing room a two-story building has been provided for the laboratory. The location is convenient to permit accurate chemical control of the mix and the type of construction gives ample daylight. The chemical laboratory is on the second floor and contains all the modern equipment. The physical laboratory is on the first or ground floor and included in

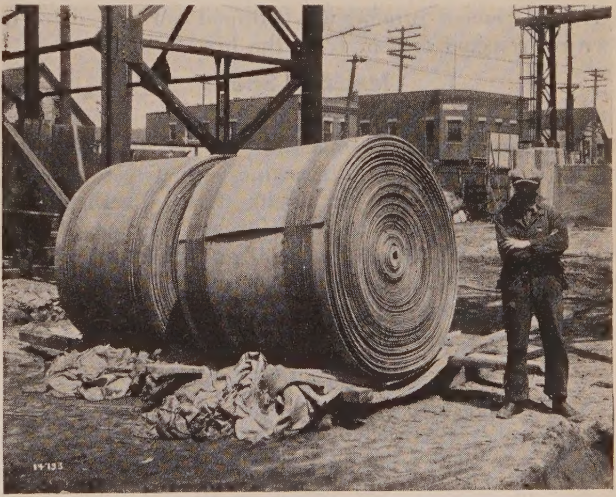


Fig. 25—The 54-inch rubber belting for limestone conveyor

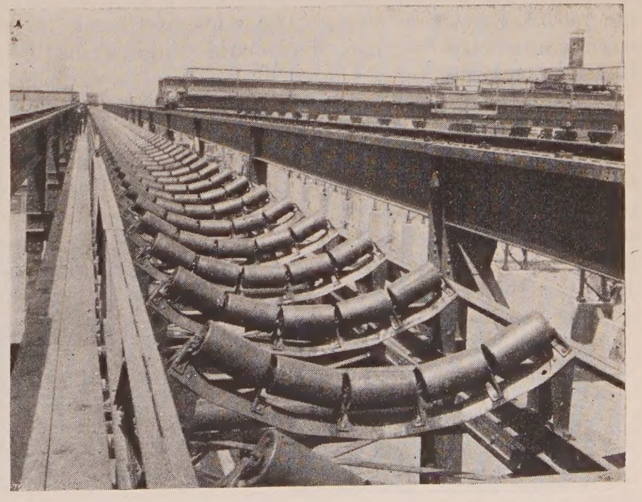


Fig. 26—Rollers and mechanical equipment for limestone conveyor before the belt was placed

---

[34] Worthington Pump & Machinery Co., Harrison, Pa.
[35] Fairbanks Morse Co., Chicago, Ill.
[36] Richardson Automatic Scale Co., Passaic, N. J.
[37] W. W. Sly Mfg. Co., Cleveland, Ohio.
[38] Bates Valve Bag Co., Chicago, Ill.
[39] Webster Mfg. Co., Chicago, Ill.

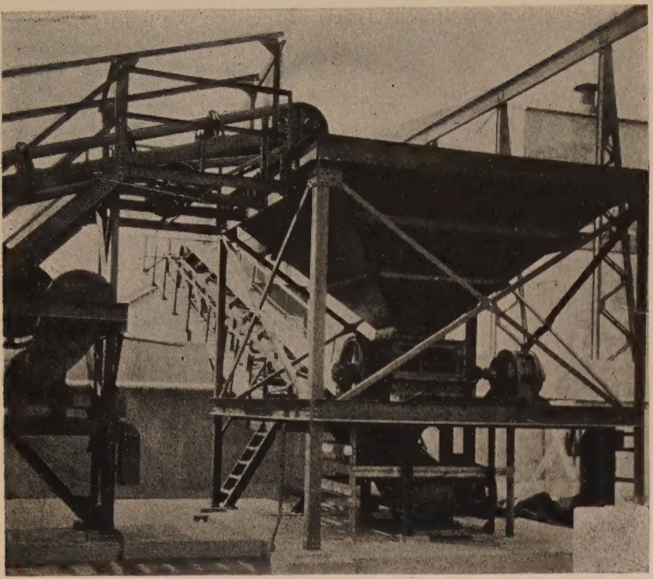


Fig. 16a—This crusher breaks up the coal before it goes to storage

the equipment are Ro Tap machine and sieves;[40] Tinius Olsen automatic breaking machine;[41] briquette tanks made with Peerless Super-cement; Tinius Olsen soap stone moist closet and an electrically heated steam boiler for testing the soundness of pats. So satisfactorily has the control of the process been worked out that the first barrel of cement ground was shipped out and there has been no rejected cement from the first.

Machine Shop

A complete machine shop located adjacent to the kiln room is equipped with machines needed for repairs to the mill equipment. The machines are driven either by individual motors or by belts from overhead line shafts and include a Buffalo forge;[42] Barker shaper;[43] Bradford lathe;[44] Atlas mandrel press; Lodge & Shipley lathe;[45] Cincinnati - Bickford radial drill;[46] power planer[47] and power hacksaw. A part of the same building serves as a storage for supply parts.

Building Construction

The buildings are all of permanent fireproof construction of structural steel or reinforced concrete with gunite or concrete walls and concrete tile roofs. All sheet metal work is of copper. The buildings all rest upon a concrete foundation underpinned with 80-ft. wood piles driven to such a depth that the piles will always be below the permanent water level. The silos and pack house were constructed by the MacDonald Engineering Co., Chicago, from designs prepared by the Peerless engineers. The gunite work was done by the Cement Gun Construction Co., Chicago.

The Peerless company took possession of the property on August 15, 1924. Permission had been granted to build the new dock, to start the piers for the kilns, to start the machine shop and to drive piles for the warehouse previous to August 15. The first clinker was produced on July 1 of this year and cement was shipped for the first time on July 24.

As stated previously, the plant is scheduled to operate with 134 men. No shift works over 10 hours. The grinding is done in two 10-hr. shifts working six days a week. Packing is on one 10-hr. shift six days a week, and the kilns and power house are operated on three 8-hr. shifts seven days a week.

The Peerless Portland Cement Co. has been making cement at its No. 1 plant at Union City, Mich., for a number of years and the Peerless brand is well known in the cement industry. Both Peerless portland cement and Peerless Super-cement are made at the No. 1 plant. It was while constructing the new Detroit plant that the company became interested in Super-cement, it having been found that the water in the Rouge river had a certain alkali content. Super-cement was used in the construction of the new dock as an additional factor of safety against possible deterioration due to the alkali.

William M. Hatch is president; John Gillespie, secretary and treasurer; C. S. Bush, vice-president; C. A. Luck is sales manager. A. F. Miller, Jackson, Mich., is consulting engineer in charge of design and construction for the company. The operating force includes C. M. Loveland, superintendent, and John Lunteigen, chief chemist.

With the favorable records that all of the men connected with the organization have back of them, and an up-to-the-minute plant in a rapidly developing territory, the continued success of the project seems assured beyond a shadow of doubt.

---

[40] W. S. Tyler Co., Cleveland, Ohio.
[41] Tinius Olsen Testing Co., Philadelphia, Pa.
[42] Buffalo Forge Co., Buffalo, N. Y.
[43] Wm. Barker & Co., Cincinnati, Ohio.
[44] Jones Machine Tool Co., Cincinnati, Ohio.
[45] Lodge & Shipley Machine Tool Co., Cincinnati, Ohio.
[46] Cincinnati Bickford Tool Co., Cincinnati, Ohio.
[47] Power Planer Co., Worcester, Mass.

Cement Output in August, 1925, Breaks Record

Production and shipments of portland cement during the month of August were the highest ever recorded for any month in the industry, according to statistics compiled by the Bureau of Mines, Department of Commerce. Production shows an increase of more than 8% and shipments of 9% over August, 1924. Portland cement stocks continue the seasonal decline but are nearly 12% greater than in August, 1924. Another new plant, located in Ohio, is included for the first time in the statistics. The following table, prepared by the Division of Mineral Resources and Statistics of the Bureau of Mines, is based mainly on the reports of producers of portland cement. The August, 1925, totals include estimates for two plants.

PRODUCTION, SHIPMENTS, AND STOCKS OF FINISHED PORTLAND CEMENT BY DISTRICTS IN AUGUST, 1924 AND 1925, AND STOCKS IN JULY, 1925, IN THOUSANDS OF BARRELS

	—Production— August		—Shipments— August		Stocks at end of Aug.		Stocks at end of July
Commercial District	1924	1925	1924	1925	1924	1925	1925(*)
East. Pa., N. J., Md.	3,621	3,726	4,263	4,402	2,092	1,784	2,460
New York	803	867	942	1,001	645	623	757
Ohio, W. Pa., W. Va.	1,707	1,810	1,882	1,905	1,018	1,517	1,612
Michigan	1,105	1,192	1,175	1,285	521	873	967
Wis. (†), Ill., Ind., Ky.	2,133	2,425	2,529	2,914	1,554	2,122	2,611
Va., Tenn., Ala., Ga.	1,049	1,302	1,241	1,263	414	303	264
East. Mo., Ia., Minn., S. Dak. (‡)	1,596	1,632	1,660	1,952	2,046	2,080	2,399
West. Mo., Neb., Kans., Okla.	1,033	1,170	1,036	1,268	1,142	1,430	1.529
Texas	414	481	433	452	245	262	232
Colo., Utah	283	210	259	230	191	362	382
California	1,063	1,181	1,056	1,234	334	381	435
Ore., Wash., Mont.	321	423	379	477	464	194	248
	15,128	16,419	16,855	18,383	10,666	11,931	13,896

(*) Revised. (†) Began producing June, 1924. (‡) Began producing December, 1924, and shipping January, 1925.

Stocks of clinker, or unground cement, at the mills at the end of August, 1925, amounted to about 5,634,000 barrels compared with 6,961,000 barrels (revised) at the beginning of the month.

Figures on imports and exports of hydraulic cement are not available for August. The total imports in July, 1925, from all countries amounted to 335,118 barrels, valued at $499,602. Exports in July, 1925, totaled 98,141 barrels, valued at $286,543.

New Standard Portland Cement Co. Starts Operation

The first part of this article, descriptive of the new Standard Portland Cement Company's plant at Painesville, Ohio, which was constructed in the record time of six months, appeared in the September issue of the Cement Mill Section of CONCRETE.

From the finish grinding mills the bulk cement is transported by Fuller-Kinyon pumps and pipe line in a tunnel under the railway tracks to the reinforced concrete silo stock house, consisting of eight circular tanks 32 ft. in diameter and 60 ft. high. The combined capacity of the circular bins and the interspaces gives a total storage of 150,000 bbls. of finished cement. The stock house as well as the pack and bag house and all other concrete work in connection with the plant was constructed by the Spencer Construction Co., Baltimore, Md.

Four Fuller-Kinyon pumps have been installed to convey the cement from the discharge openings in the bins through pipes to the pack house. Pipe nozzles provided in the bin walls admit air under pressure to overcome any arching action of the stored cement in the bins. The Fuller-Kinyon pumps in the stock house are each operated by a 50-h.p. General Electric motor through a D. O. James speed reducer [16] with high speed of 720 and low speed of 100 r.p.m.

Pack House

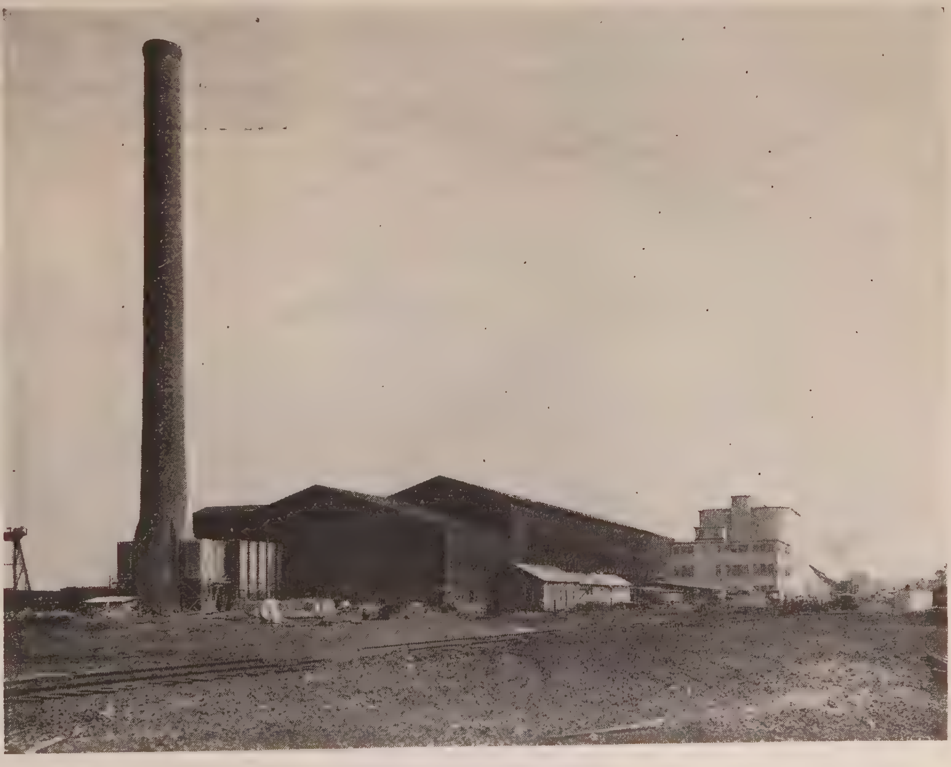
The bag and pack house is very conveniently arranged and is of reinforced concrete construction throughout. It is a three-story structure equipped with an Otis elevator[17] serving all floors. There are four Bates packers [18] assuring prompt shipments of cement packed either in Regal Sack Co. cloth sacks or in Bates multi-wall paper bags.[19] Cars can be placed on tracks on either side of the pack house and loaded by a belt conveyor which receives the filled bags from the packing machines. Two of the four machines are served by each conveyor.

The bag storage is on the second and third floors. A 36-in. belt conveyor made by the Variety Iron and Steel Co. handles the return bags from the elevator to the chute to the bag cleaner. The sacks are sorted on the second floor on the belt conveyor and any excess of old cement is dumped from the sacks into the three hoppers with openings on a level with the belt conveyor and discharging into pipes through the floor. The main sack storage is on the second floor where the sacks are also tied ready for filling on the valve bag machines.

The bag cleaner, built in Nazareth, Pa., is of the continuous type with two discharging hoppers for the reclaimed material. It is driven by a 15-h.p. General Electric motor with a Hill clutch speed reducer[20] and chain drive.

On the third floor are located two Sly dust collectors,[21]

Fig. 13—Exterior view of Standard Portland Cement Company's plant at Painsville, Ohio



---

[16] D. O. James Mfg. Co., Chicago, Ill.

[17] Otis Elevator Co., New York City, N. Y.

[18] Bates Valve Bag Co., Chicago, Ill.

[19] Hill Clutch, Machine & Foundry Co., Cleveland, Ohio.

[20] W. W. Sly Mfg. Co., Cleveland, Ohio.

[21] Bury Compressor Co., Erie, Pa.

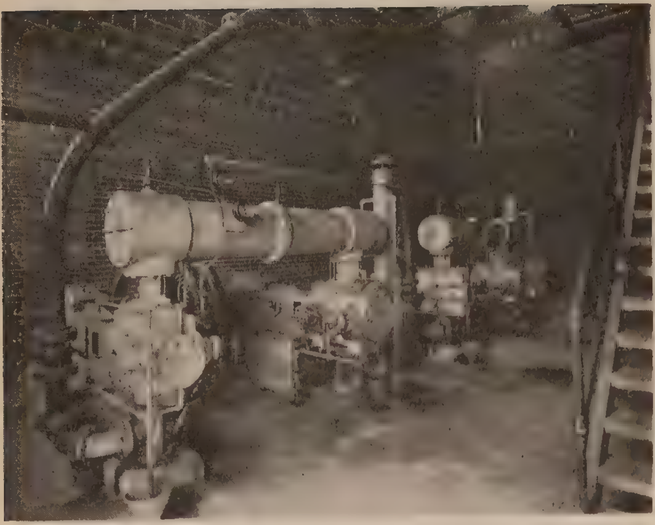


Fig. 14—Interior view of air compressor room

each equipped with a No. 45 American Blower Sirocco fan direct connected to a 10-h.p. motor. These dust collectors collect the cement dust from the packing machines below. The bag storage on the third floor is principally for returned bags. The 36-in. belt conveyor connects the elevator with the bag cleaner slide hopper.

Power

Electric power is available on favorable terms which obviate the use of waste heat boilers. The power is purchased from the Diamond Alkali Co. and is transmitted about one-half mile to the cement plant. The switchboard and other electrical equipment are located in the main mill building adjacent to the grinding room and on the second floor, over the compressor room.

Each kiln discharges its hot gases into separate dust chambers with baffle plates, the two dust chambers connecting with the same stack. The stack is built of brick and is of ample size to serve both kilns.

Air pressure to agitate the slurry, to break down arches in the cement storage bins and to operate the Fuller-Kinyon pumps is rovided by two 14x8x10 Bury air compressors, with 400 cu. ft. capacity each and maximum pressure of 100 lbs. The air compressors are driven by 100-h.p. General Electric synchronous motors. Other

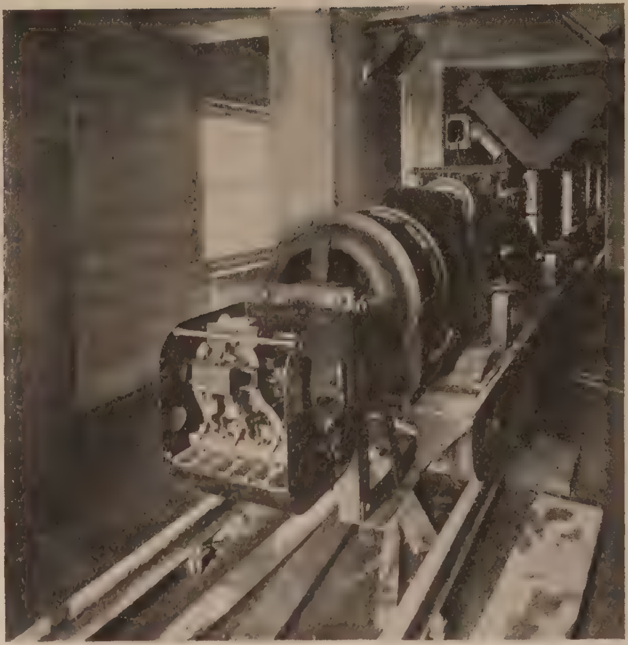


Fig. 16—Tunnel beneath silo stock house from which cement is forced by Fuller Kinyon pump to the pack house

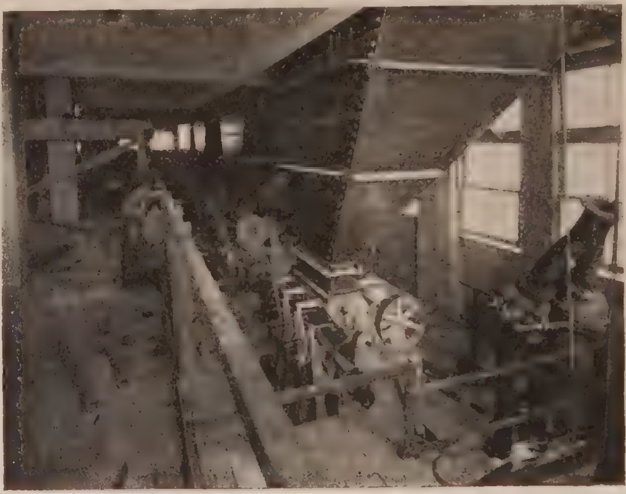
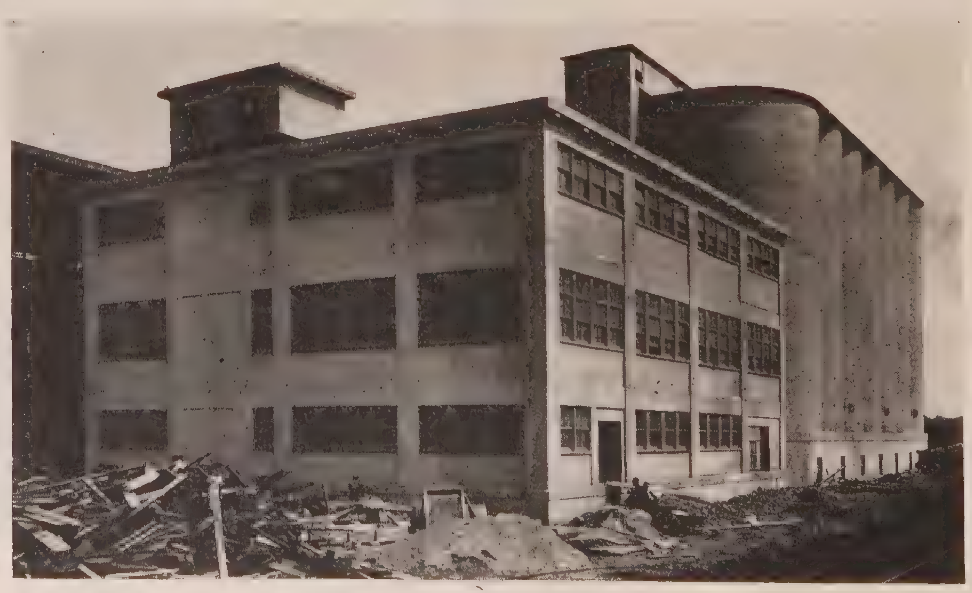


Fig. 17—Four Bates packers

Fig. 15—Three-story bag and pack house and silo stock house



equipment in the compressor room includes two 65 k.w. direct current generators and 100-h.p. induction motors.

Laboratory

A complete office and laboratory building of reinforced concrete is planned, and pending its completion temporary offices and laboratory are located in frame buildings conveniently arranged at the plant site. The most modern equipment is being provided to equip the laboratory and to insure proper control of the manufacturing process to produce a superior quality of cement.

The construction work at the plant was subdivided. All of the miscellaneous concrete work was done by day forces of the company. The Spencer Construction Co., Baltimore, Md., did all the heavy concrete construction work, such as the silos and packing house and the concrete foundations. The steel was erected by the Fort Pitt Bridge Co., of Canonsburg, Pa. The plant was designed and built under the supervision of the Fuller-Lehigh Co., Fullerton, Pa.

Shipping Facilities

The plant is connected by private trackage to the Fairport, Painsville & Eastern Railway, which gives a direct outlet over the New York Central, Nickel Plate and B. & O. Railroads providing 24 to 48-hour delivery service. A highly competitive territory in Pennsylvania, New York and Ohio is served with the "Standard" brand of cement.

Organization

Included in the organization of the Standard Portland Cement Co., to whose efforts the success of the project is attirbuted are: T. R. Evans, president; C. N. Windecker and W. A. Davis, vice-presidents; C. A. Follett, secretary; A. H. Ingley, treasurer; Erie J. Ochs, superintendent, and Louis C. Creveling, chief chemist.

Mr. Davis, who is in charge of the sales organization for the new company, has had wide experience in the cement industry, having been connected with the Lehigh Portland Cement Co. in Chicago, Ill., for several years and later with that company in the eastern cement regions.

Superintendent Ochs was formerly chief chemist for the Cowell Portland Cement Co., Cowell, Calif., and Mr. Creveling was recently connected with the Indiana Portland Cement Co., Greencastle, Ind. C. F. Deemer is assistant superintendent.

The Standard company's main office is in the Union Trust Bldg., Cleveland, Ohio. "Standard for Strength" is the motto which forms a part of the new trade-mark or brand label. Although the name "Standard" is not new to the cement industry, the Standard Portland Cement Co. of California having been known, especially on the western coast for a number of years, the new Standard label is attractive and appropriate and worthy of a place among others which represent the different brands of high-grade portland cement.

New Alumina Cement Plant in Indo-China

The Lafarge interests, the original owners of the "ciment fondu" patent in France and in England, are finding such an increasing demand for their product that they have been compelled to open a new plant to take care of the rapidly developing demand from Indo-Chine and other sections of the Extreme-Orient.

The "Societe Indo Chineise du Ciment Fondu Lafarge" has been organized with a capital of 6 million francs for the purpose of manufacturing and selling "ciment fondu" (Alumina cement) in the Extreme-Orient. The parent company, the "Chaux et Ciments de Lafarge et du Teil" of Viviers, France, has furnished the newly formed company their processes of manufacturing "ciment fondu" and the specifications and designs for factory buildings and machinery to be installed. They receive in return four hundred shares in the new company, plus a royalty of 5% figured on the net benefits calculated in advance of all dividends, reserves or amortissements.

It is probable that the manufacture of the "ciment fondu" will be placed under the technical direction of the "Ciments Portland de l'Indochine" company and that the first plant with an annual capacity of from 12,000 to 15,000 tons will probably be built near d'Haiphong. All raw materials, with the exception of bauxite which will have to be imported, is available in the immediate vicinity.

The following constitution was adopted:

"Societe Indochinoise du Ciment Fondu Lafarge."

Chartered with a capital of 6 million francs in shares of 500 francs to be subscribed in cash. Object:— Manufacture and sale in the Extreme-Orient of the Lafarge ciment fondu. "Les Chaux et Ciments de Lafarge et du Teil," in remuneration of the use of their patents, methods, etc., receive 400 of the 1,600 shares issued as well as a royalty of 5% of all net benefits calculated in advance of all reparation, amortissements and reserves. Main offices at 1 rue de Stockholm, Paris, France. Directors: MM. Daher, de Waubert de Genlis, Ferrant, Marchegay, Pavin de Lafarge, Perpignani, Peschart d'Ambly.

Employees' Representation Can Be Successful

The success of employees' representation in industry, through which approximately 800 companies are now attempting to solve their labor problems, depends largely on the ability of employers to understand the point of view of wage earners, to secure their cooperation, and to develop leadership among them. This is indicated in a 500-page report issued today by the Department of Industrial Studies of the Russell Sage Foundation. While the report is based on a 5-year study of employees' representation in the coal mines of the Colorado Fuel and Iron Co.—undertaken by the Foundation in 1919 and completed last summer—it is pointed out that the analysis of the relations between employer and employe in this industry is true also of the railroads,the packing industry, the textile industry and other important branches of American business.

Men and Mills

Notes from the Field

Philadelphia in the last several months has risen from a minor import center for foreign cement shipments to a place of pre-eminence in this important building material. Recently there has been an increase in imports placing Philadelphia far in the lead of all other American ports. The German steamship *Luise Hemsoth*, discharged 24,000 bbls. of Belgian cement loaded at Antwerp. Most of this consignment will be sold to builders in South Philadelphia and the suburban districts.

Increased building developments in the outlying districts, coupled with the erection of numerous skyscrapers in the central part of the city and several large apartment buildings have created an unprecedented demand for the Belgian product. All the foreign cement is imported in bags almost similar in size to the American standard.

Few other ports in the United States have received shipments from abroad and none of these has ever, to the knowledge of importers in the Philadelphia district, imported full cargoes. Philadelphia's trade has been in entire shiploads, averaging about 5000 tons to each ship. Southern ports now are receiving cement in parcel lots in the regular line steamships trading from Antwerp.

The Philadelphia Export Company imports the cement, while the Philadelphia Import Company is the distributor.

Development in the lime and limerock fields of Shelby speeded up, according to announcement from that section of Alabama, the lime and stone production from that section showing a healthy increase during the past few months.

The Superior Lime and Hydrate Co., of which H. G. Bridgewater is president, has plans completed for the addition of two modern kilns. Though but two years in operation this concern is shipping 500 bbls. of lime daily, the product being used extensively in Alabama. This plant is located on the Louisville & Nashville, and on the Atlanta, Birmingham & Atlantic Railroads, about 50 miles from Birmingham, Ala.

The big cement plants of the Birmingham district, as well as in other sections of Alabama, are being operated on full time and their product is being shipped to consumers and dealers about as rapidly as it is being turned out.

More cement than ever before in the history of Alabama is going into streets and roads and into numerous big buildings in Birmingham and in other sections of Alabama. The demand for cement in Alabama, as well as in other Southern States, is increasing annually.

Birmingham cement makers say that with the great developments in Florida that state will take more cement than ever before.

In Birmingham and in the Birmingham district many houses of the Spanish style of architecture are being built of concrete. In fact, in one new fashionable residential section of the city only concrete houses of the Spanish style are being erected.

The Kansas Public Service Commission recently dismissed the complaint of the Lehigh Portland Cement Co. that rates on cement from Kansas are unreasonable. The state commission's action was based upon the approval by the I. C. C. of the decision of L. J. Flynn, examiner for the Federal body, upholding the present rates.

The Atlas Portland Cement Co., of Northampton, Pa., has acquired part of the Gower farm near Kunkletown, Monroe county, adding it to its already large holdings, either by ownership or lease of all the mineral rights, with few exceptions, along the Chestnut Ridge Mountains from Kunkletown to Saylorsburg.

The steel barge *El Morro*, on which the Cuban flag was raised at the dock of the Virginia Portland Cement Corporation at South Norfolk, was towed out of the harbor on August 15 by the Munson Line steamer *Hunplace*, which was to deliver her at Havana, where she will enter service.

The *El Morro*, which can carry 5,000 bbls. of cement in bulk, will be used to transport cement from the plant of the Cuban Portland Cement Corporation at Muriel Bay to Havana, 40 miles distant. The Cuban Portland Cement Corporation is a member of the International System.

A. G. Watts, service manager of the Lehigh Portland Cement Co., recently addressed the Rotary Club of Allentown, Pa., on the growth of the cement industry in the Lehigh Valley.

A heavy blast was set off in the quarry of the Giant Portland Cement Co. early in September that will provide rock for future operations at the cement plant.

Installation of dust collectors at the plant of the Whitehall Cement Co. has been completed and the finished equipment put into operation.

H. M. Hess, Humbolt, Kansas, has been appointed chief chemist for the Giant Portland Cement Co., Egypt, Pa. Norman Kresge has also joined the Giant company's laboratory force.

Many trucks are visiting the cement mills in the Lehigh Valley district daily for immediate deliveries of cement. It is announced that the demand is probably at the peak for the year, with cement being packed before it has had time to cool.

The Nazareth Portland Cement Company recently gave a clam-bake to its employes and their families and some invited guests. Several hundred attended it at the company's grounds near Stockertown. Games were played and prizes were awarded to the winners. The program began at 9:30 a. m. and the clam-bake was served at 1 o'clock.

A settlement of the Charleroi strike in Belgium is in prospect, with concessions from both employers and workers, according to a cable from Commercial Attache Allport at Brussels. The window and plate glass industries and the cement industry are active. A general gratification concerning the terms of settlement of the Belgian debt to the United States has been tempered by some misgiving with regard to the effects of transfers upon Belgian exchange.—*Commerce Reports.*

Officials of the Union Pacific railroad are hurrying the laying of tracks from Boettcher, Colorado, the junction point, to LaPorte, Colorado, where the new $2,000,000 cement plant of the Ideal Cement Co. is located. LaPorte is six miles northwest of Fort Collins. Contracts are being let for machinery so that as fast as the housing is erected the machines will be placed and there will be no delay along any lines.

The Midwest Portland Cement Co., incorporated under the laws of Colorado, specifies its capitalization as $6,000,000. Non-assessable stock will be sold. The officers are: R. J. Meissier, president; Ben Gibson, vice-president, and A. F. Takamine, secretary and treasurer. It owns 960 acres of land on the Arkansas river, 20 miles west of Pueblo and five miles from Portland, Colorado. Hartley and Dorman are the engineers for the company, and it is conservatively estimated that there is sufficient raw material in the land owned to supply enough of material to manufacture 2,500 barrels of cement every day for hundreds of years. The plant is to be a wet process plant. Two railroads are close to the site. water is plentiful and the site of the raw material will be 300 ft. above the plant. A gravity system is planned to transport the commodity to the plant proper. The plant is to cost between one and two million dollars.

The Southwestern Portland Cement Co. has leased office space in the Schmidt Bldg., Cincinnati, Ohio, and will establish a sales office in the new quarters.

Trade Publications

Three bulletins have recently been issued by the Pennsylvania Pump and Compressor Co., Easton, Pa., as follows: *Bulletin No. 122* describes Pennsylvania aftercoolers. *Bulletin No. 123* describes Class 3-A and 4-A air compressors and Class 7-A and 8-A vacuum pumps—straight line, single stage types—power and steam driven. *Bulletin No. 124* describes Pennsy portable air compressors. An important feature of Pennsylvania compressor construction described in *Bulletin 123* is the Pennsylvania Eclipse cushion ring The discussion of aftercoolers is complete and the bulletin on this subject is of considerable interest to the user of compressors.

Brown Indicating and Recording Tachometers, Catalog No. 44 and *Brown Recording Pressure and Vacuum Gauges*, Catalog No. 74, have been issued by the Brown Instrument Co., Philadelphia, Pa. These new catalogs are each 8x10½ in. in paper covers, attractively illustrated and describe the equipment indicated in the titles. The illustrations show actual installations in the various fields to which they apply.

Mineral Resources of the United States in 1924, is the name of a report recently issued by the U. S. Geological Survey, Department of the Interior, Washington, D. C. It is a summary report, and contains statistics of all metallic and non-metallic minerals produced in the United States during 1924 and during previous years. This booklet may be secured upon application to the Superintendent of Public Documents, Government Printing Office, Washington, D. C.

The D. O. James Manufacturing Company, Chicago, manufacturers of Gears, Spur Gear Speed Reducers, Worm Gear Reducers and Couplings, announce their new general catalog No. 99 of 288 pages which covers their complete line of products.

It is fully illustrated and contains many pages of general engineering data which is of interest to engineers, designers and purchasers of transmission equipment. This catalog is the result of much study—and contains such information as is constantly needed in designing and specifying drives of all kinds on elevating, conveying, power transmitting and process machinery. It will be sent free of charge to responsible parties upon request.

New Sullivan Angle Type Portable Compressor

The machine shown in the accompanying illustration has been designed by the Sullivan Machinery Co., Chicago, Ill., to meet the demand for portable compressors of large capacity. The same size compressor cylinders have been utilized as in the 110-ft. Sullivan portable, but there are four of these cylinders set in pairs, each pair being at right angles with the other or at an angle of 45° with the vertical axis of the machine. The cylinders operate from a single crank shaft. The weight is kept to a low figure, 5360 lbs. complete, not including oil, water and gas. The gas and air tanks are suspended in brackets at the compressor end of the rig, the air receiver being 20 by 60 in. in size. The equipment includes standard Sullivan portable compressor fittings. This compressor is recommended for operating two or three rotator rock drills, three or four concrete breakers or tampers and seven to nine riveters or clay spaders, etc.

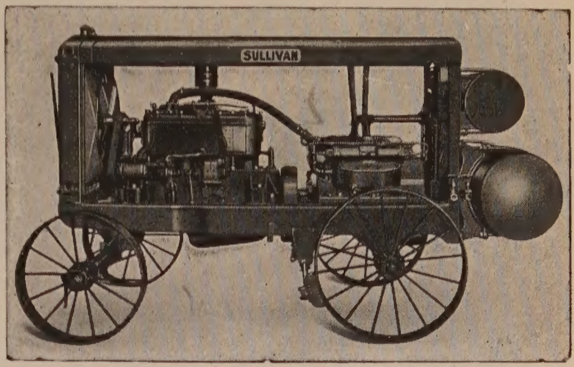
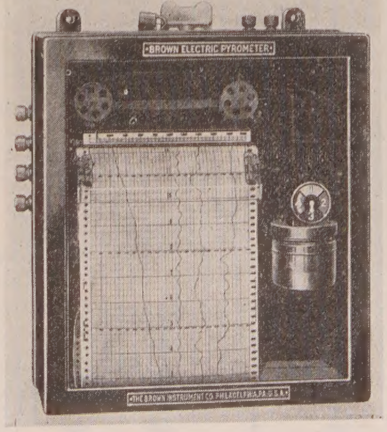


Fig. 1—Sullivan portable air compressor

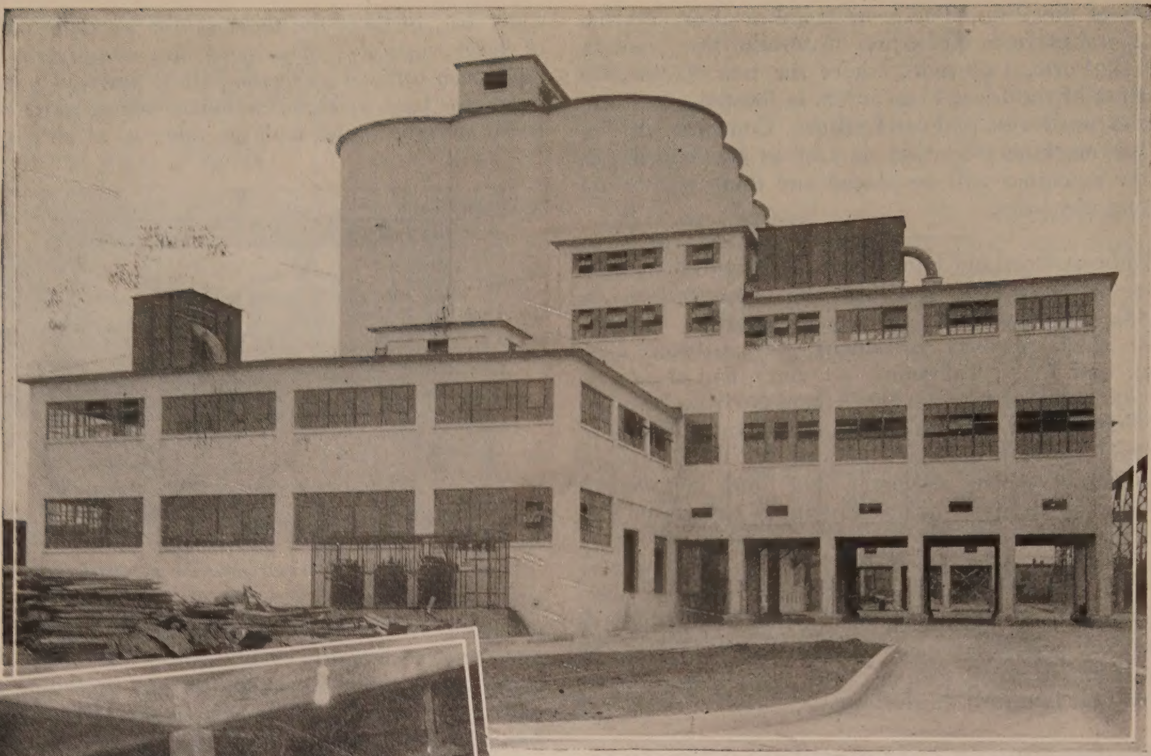
Brown Recording Pyrometer

The accompanying illustration shows the new Brown electric recording pyrometer recently announced by the Brown Instrument Co., Philadelphia, Pa. This addition to the line of Brown recording instruments enables the operator to tell at a glance the stack temperature or temperatures of gases at other important points.

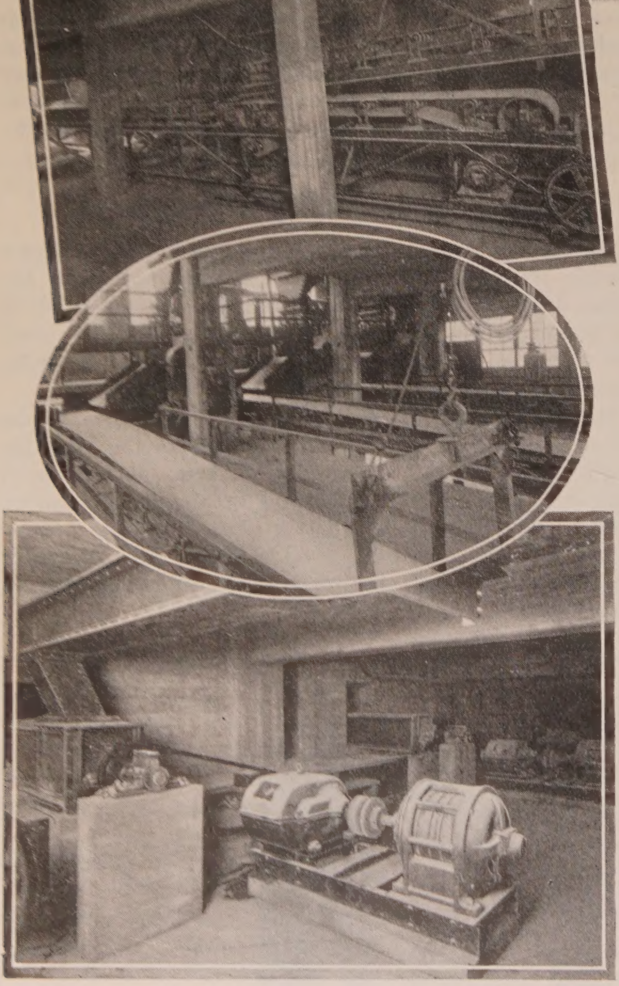
The marking ribbon may be moved back to make the record visible and a support is provided for the hand for writing notes on the chart, such as items about special runs, etc. There is a glass tear-off for the chart, insuring a neat appearing record. The recorder may be opened up to show the assembly, making visible and accessible the galvanometer and chart-driving mechanism with speed change gears.



New Brown recording pyrometer



Designed and Built by MacDonald Engineering Co., Chicago



In the Storage and Packing Plant

Webster material handling equipment is used throughout in the packing and storing operations at the new plant of the Peerless Portland Cement Company at Detroit, Mich.

This is but another of the many instances of implicit reliance placed upon Webster equipment by leading organizations everywhere.

Webster engineers have given years of study to correct material handling methods and can ably assist in selecting equipment to meet your particular requirements. Let them help you.

THE WEBSTER MFG. COMPANY
4500-4560 Cortland Street
CHICAGO

WEBSTER